Climate Council of Australia

Submission to:	Electricity and Energy Sector Plan
Addressed to:	Electricity and Energy Sector Plan Taskforce, Department of Climate Change, Energy, the Environment and Water energyandelectricitysectorplan@dcceew.gov.au
Submission from:	Climate Council of Australia Ltd 223 Liverpool St, NSW 2010 Tel: 02 9356 8528 Email: info@climatecouncil.org.au

26 April 2024

About the Climate Council

The Climate Council is Australia's own independent, evidence-based organisation on climate science, impacts and solutions.

We connect decision-makers, the public and the media to catalyse action at scale, elevate climate stories in the news and shape the conversation on climate consequences and action, at home and abroad.

We advocate for climate policies and solutions that can rapidly drive down emissions, based on the most up-to-date climate science and information.

We do this in partnership with our incredible community: thousands of generous, passionate supporters and donors, who have backed us every step of the way since they crowd-funded our beginning as a non-profit organisation in 2013. To find out more about the Climate Council's work, visit www.climatecouncil.org.au.

Introduction

The Climate Council welcomes the Australian Government's consultations for the Electricity and Energy Sector Plan (EESP).

The development of this sector plan is an important opportunity for designing an electricity and energy system which is fit for purpose to enable a thriving zero emissions economy. The delivery of a much larger, more resilient and reliable clean electricity grid underpins Australia's transition to a zero carbon future. Without it, we cannot decarbonise our domestic economy to its full potential, or lay the foundations for Australia's next era of prosperity with clean industries. The EESP will, to a large extent, determine the feasible emissions reduction pathways for every other sector currently being considered. The design of the new energy system must cater for the needs of all Australian industries, sectors and communities. It is essential we get this right, by planning for a clean energy system which can anticipate and unlock decarbonisation options right across Australia's economy.

2023 was the Earth's hottest year on record by a large margin (NOAA, 2024). July 2023 was the first time in which the global average temperature rise spiked 1.5°C above pre industrial levels (WMO, 2024). We are all living in this age of climate consequences with extreme heat waves in southern Europe, North America and China, devastating wildfires in Canada and Hawaii, and deadly floods in India, Brazil and Libya. Scientists were shocked by record-breaking sea surface temperatures globally in 2023 and record low sea ice extent around Antarctica. Meanwhile, Australians have lost homes or livelihoods to fires or floods, been forced to pay higher prices for food or insurance, stayed indoors to avoid bushfire smoke blanketing our cities, been unable to get home due to heat-related transport disruptions, or witnessed our landscapes and wildlife being devastated by bushfires (Climate Council 2023b). The most recent summer has given Australians 'climate whiplash' - throwing communities violently from one extreme weather event to another (Climate Council, 2024a).

There is no safe level of global warming, and every fraction of a degree matters. Striving to limit global average temperature rise to 1.5 °C is considered essential to avoid far more severe and irreversible changes to our climate. Therefore, it is essential that Australia puts in place real plans for rapidly driving down emissions this decade, and beyond.

The good news is that the energy transition is gaining momentum. Globally, more renewable energy generation capacity is being added every year with 2023 holding the record for increasing it by almost 50% to nearly 510 gigawatts (GW). Countries

have also agreed to work together to triple the world's installed renewable energy capacity by 2030 at the 2023 United Nations international climate change conference in Dubai (COP28). In Australia, affordable and clean renewable energy generation and storage continues to grow. More than 40% of the electricity in the National Electricity Market came from renewable sources during the final six months of 2023 (OpenNEM, 2024), demonstrating that the shift to a clean energy economy is underway. We need to leverage this momentum to build an energy system that is consistent with Australia's economic ambitions and securing our place in a decarbonised global marketplace.

With this submission, Climate Council has responded in detail to a range of the consultation questions and points raised in the discussion paper. Our input is broadly aggregated into four key positions which should shape the development of the EESP:

1. **Plans to cut climate pollution must recognise the urgency of the climate crisis:** Australians are already experiencing hazardous, and sometimes deadly, effects of a 1.2°C of global temperature rise (Climate Council, 2023b). Wide spread bushfires, severe flooding, deadly heatwaves and the accelerated decline of Australia's precious natural ecosystems like the Great Barrier Reef have become routine headlines over the Australian summer. The Australian Government must recognise the harms and urgency of the climate crisis and take commensurate action. This means the Australian Government, through the EESP, should align decarbonisation targets as close as possible with a carbon budget that provides a 67% chance of limiting warming to 1.5°C and achieve net zero by 2035.

2. **Renewable electricity is the foundation on which we build our clean economy:** To decarbonise Australia's economy to its full potential and seize the opportunities of domestic clean industry, we need to plan for a much larger, fully renewable grid. The Climate Council's analysis indicates Australia will need more than 200 GW of renewable generation and storage capacity by 2030, and more than 600 GW by 2050 as a minimum. This will require a significant step-up in action and investment from current government plans. This section discusses elements that respond to questions 2, 3, 9 and 11 in the EESP discussion paper.

3. **Electrification and energy efficiency move together to manage demand:** Distributed consumer, commercial and industrial energy resources represent a significant opportunity to continue growing our clean electricity grid, while managing a range of challenges such as distribution capacity, land use and social licence. We will need to optimise both the deployment of large scale renewables and consumer and industrial energy resources to build a grid of

the size and resilience Australia needs in the coming decades. Australia should be planning to deploy another 24GW of household rooftop solar by 2030 and further commercial and industrial additions through a combination of direct policy support and regulatory frameworks. This section discusses elements that respond to questions 2, 3, 4 and 7 in the EESP discussion paper.

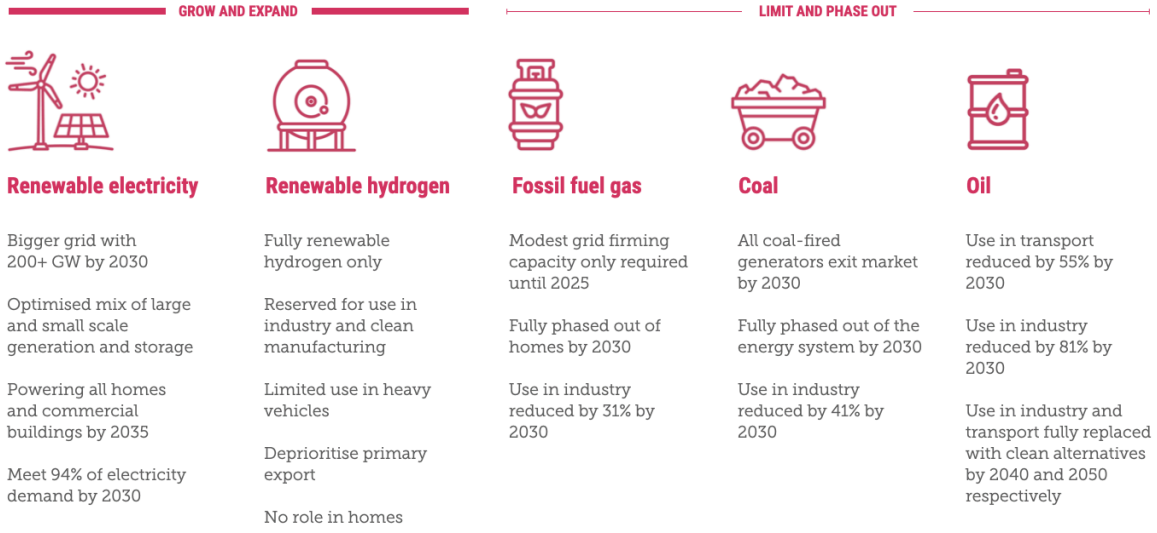
4. **Design for a limited and diminishing role for fossil fuel gas:** The role of gas is limited and declining as Australia and our international partners pursue necessary decarbonisation. Electrifying Australia's homes, businesses and industries to reduce the use of gas is a key opportunity to cut emissions rapidly this decade. The Climate Council's analysis indicates gas can be fully phased out of energy in homes and reduced in industry by almost a third by 2030. The EESP should chart a course that explicitly accelerates the current momentum by planning for the displacement of gas demand through electrification and energy efficiency across the Australian economy. This should be reflected both in planning for the ongoing build of our larger clean electricity grid, an orderly phaseout of the gas network to avoid death spiral conditions and in the prioritisation of electrification measures over gas supply. This section discusses elements that respond to questions 5 and 7 in the EESP discussion paper.

5. **The government needs to lead with decisive action and help navigate towards a zero emissions energy system for Australia:** The scale of Australia's necessary electricity build will require an integrated mix of government enabling measures and market-led initiatives to maximise private investment. Governments at all levels should prioritise addressing barriers and blockages to mobilising private investment, with particular priorities being to addressing skills and workforce; supply chain; planning; and social licence issues. Governments also have a particular role to play in ensuring Australia's move to clean energy is inclusive, by supporting households and communities who would otherwise be excluded from the benefits of clean energy to access them. This section discusses elements that respond to questions 2, 5, 8, 10 and 11 in the EESP discussion paper.

Our recommendations draw upon extensive modelling[1], which outlines an achievable pathway for cutting emissions by 75% below 2005 levels by 2030. This is what is required for Australia to make a fair contribution to limiting

[1] The results of this analysis was published in the report Seize the Decade – carried out in collaboration with the Institute of Sustainable Futures at the University of Technology Sydney, on how Australia can achieve 75% emissions reductions by 2030 . Further details can be found here: https://www.climatecouncil.org.au/resources/seize-the-decade/

temperature rise to well below 2°C. Discussion on the themes are detailed in the following sections. A summary of our recommendations on the development of energy sources is illustrated in the following figure.



Summary of recommendations

Recommendation 1

Based on analysis of emissions to date and our country's relative capacity to make deep reductions now, globally renowned scientists conclude that Australia should aim to cut climate pollution by 75% by 2030 compared with 2005 levels, and reach net zero by 2035.

2050 is far too late as a target date for achieving net zero across the Australian economy. In preparing this sectoral plan, the Australian Government should work to cut pollution further and faster this decade, with the aim of achieving net zero by 2035.

Recommendation 2

The Climate Council recommends the EESP map out a pathway for delivering significantly expanded renewable generation and storage capacity beyond current government plans this decade. This should be based on delivering at least 200GW of clean generation and storage by 2030, continuing to scale up to 2050 in line with AEMO's Green energy exports scenario in the 2024 Integrated System Plan and the scenarios provided in Climate Council's Appendix 1.

Recommendation 3

In mapping a pathway for significantly expanded renewable generation and storage capacity, the Climate Council recommends this be based on an optimised mix of utility and consumer energy resources which maximises the potential of all forms of renewable electricity. Both large and small-scale generation and storage will be essential to delivering the power Australia needs rapidly, and at scale. In particular, the Climate Council recommends an increased focus on expanding residential, commercial and industrial solar and onshore wind as near-term priorities to bring more renewable generation capacity online sooner.

Recommendation 4

The Climate Council recommends the EESP anticipate and make provision for the accelerated end of coal-fired power generation within Australia's electricity grid. This would acknowledge that AEMO's current expected end date of 2038 has been progressively revised over time, and ongoing changes in the economics of the electricity market make earlier closure of coal generators highly likely.

Recommendation 5

The Climate Council recommends the EESP plans for gas to only be used for short-term reliability and peaking capacity, and explicitly rule out the further development or expansion of gas-fired power generation within Australia's electricity networks – unless it can run on 100% renewable hydrogen. There is sufficient capacity already in place, as zero emissions long-duration and distributed storage options are rolled out.

Recommendation 6

The Climate Council recommends the EESP adopt electricity demand assumptions based on strong levels of electrification and improvements in energy efficiency across homes and businesses, and outline key policy and regulatory actions to enable this. In particular, the EESP should include government-led initiatives to ensure all new homes and commercial buildings are built to high efficiency standards, with all-electric and efficient appliances and rooftop solar wherever possible.

Recommendation 7

The Climate Council recommends the EESP adopt electricity demand assumptions based on prioritising the full electrification of public and shared vehicle fleets, and significantly increased uptake of shared and active transport compared with current levels. This would recognise that Australia's optimum emissions reduction pathway involves greater use of shared and active transport

modes, rather than a direct conversion of the entire private vehicle fleet to electric vehicles. The EESP should also account for a significant increase in electrified road freight and rail in future decades, which will require additional infrastructure planning and network augmentation alongside additional generation capacity.

Recommendation 8

The Climate Council recommends the EESP recognises and addresses the potential for technologies such as vehicle-to-grid discharging to provide additional distributed energy storage capacity as more of Australia's fleet electrifies.

Recommendation 9

The Climate Council recommends the EESP recognise the opportunities for electrification and energy efficiency in industry and make provisions for significant direct fuel switching to clean electricity in industry in the near term to enable these opportunities. To meet the high demand for energy, the EESP needs to consider the strategic placement of large-scale renewable electricity generation and industrial activities to optimise transmission and generation infrastructure developments.

Recommendation 10

The Climate Council recommends the EESP explicitly prioritises the use of renewable hydrogen for replacing fossil fuel inputs and high-temperature process heat in industry. Given the inefficiencies and challenges for storing and transporting hydrogen, the EESP should not assume renewable hydrogen will be deployed as an energy source in households, transportation or directly in exports.

Recommendation 11

The Climate Council recommends the EESP rules out any reliance on CCS or CCUS as a method for reducing emissions from fossil gas and makes provision for a full replacement of fossil gas with genuinely zero emissions alternatives. This will require actions and policies supporting increased renewable electricity production specifically to produce zero emission fuels like renewable hydrogen.

Recommendation 12

The Climate Council recommends the EESP recognises the diminishing role of gas as all sectors electrify and sets realistic timeframes for winding down gas distribution networks in an orderly way, starting with an immediate end to any further augmentation. It is critical that governments plan and deliver an orderly

transition for the cessation of the gas network to minimise negative impacts on the community, consumers, and investors.

Recommendation 13

The Climate Council recommends the EESP plans for rapid domestic and international reductions in demand for fossil gas, with a clear pathway for ending fossil gas extraction and use as soon as possible.

Recommendation 14

The Climate Council recommends the EESP identifies actions, investment plans and timeframes for all levels of government to collaborate on growing Australia's skilled energy workforce - both by training new workers and updating the skills of current energy workers. This submission provides a number of priority recommended policy actions for implementation this decade to achieve this.

Recommendation 15

The Climate Council recommends the EESP identifies actions, investment plans and timeframes for all levels of government to collaborate on enabling energy efficiency and electrification upgrades for communities and individuals who are otherwise at risk of being excluded from the shift to clean energy. This submission provides a number of priority recommended policy actions for implementation this decade to achieve this.

Recommendation 16

The Climate Council recommends the EESP identifies priority actions for immediate implementation that can enable local communities to engage in, and help to accelerate, Australia's shift to clean energy. These processes should prioritise community voice, autonomy and genuine benefits sharing. This submission provides a number of priority recommended policy actions for implementation this decade to achieve this.

Recommendation 17

The Climate Council recommends that the EESP integrates with other sectors as they inform the development of the national Net Zero Plan. The EESP should be developed on a timeline and implementation pathway that enables Australia to reach net zero well before 2050, starting with actions that are consistent with achieving a 75% reduction in emissions by 2030. The EESP also needs to stipulate processes, procedures and structures that the government needs to set up to ensure cross-sector policy coherence throughout planning and implementation.

1. Plans to cut climate pollution must recognise the urgency of the climate crisis

Climate Council acknowledges that the Australian Government is developing a Net Zero 2050 Plan, and the EESP is a key input to this.

Recognising the enormous risks of global warming beyond 1.5°C, Australia's emissions reduction plans and targets should aim to limit warming as far as possible and with the highest probability of success. This means aligning as close as possible with a budget that provides a 67% chance of limiting warming to 1.5°C. Based on analysis of emissions to date and our country's relative capacity to make deep reductions now, globally renowned scientists conclude that Australia should aim to cut climate pollution by 75% by 2030 compared with 2005 levels, and reach net zero by 2035 (Climate Council, 2023b).

Recommendation 1

Based on analysis of emissions to date and our country's relative capacity to make deep reductions now, globally renowned scientists conclude that Australia should aim to cut climate pollution by 75% by 2030 compared with 2005 levels, and reach net zero by 2035.

2050 is far too late as a target date for achieving net zero across the Australian economy. In preparing this sectoral plan, the Australian Government should work to cut pollution further and faster this decade, with the aim of achieving net zero by 2035.

2. Renewable electricity is the foundation on which we build our clean economy

Combining existing technologies with Australia's abundant renewable energy resources, we are well positioned to rapidly build a decarbonised economy. We need to fully decarbonise our electricity grid as we build a zero emission energy system big enough to meet the needs of domestic decarbonisation across all sectors and lay the foundations for clean industries that will be key to ensuring Australia's next era of economic prosperity. The essential components of this are:

1. Plan to deliver a bigger, fully renewable and more distributed system capable of meeting increased clean electricity demand from all sectors of the Australian economy as each pursues the maximum genuine and permanent decarbonisation possible;
2. Ensure stable, resilient and reliable renewable electricity supply by deploying a mix of technologies, including greater use of onshore wind, residential, commercial and industrial solar, and distributed storage;
3. Phase out coal-fired power generation sooner as reliable zero emission alternatives are rapidly brought online, and minimise the role of gas.

By taking these steps, the electricity sector can cut its own emissions further and faster this decade than current government plans, and enable the widespread decarbonisation of Australia's broader economy in the years to come.

2.1. The renewable electricity system needs to be bigger than current government plans

To remove fossil fuels to the greatest possible extent across all major sectors in Australia, we will need a larger clean electricity system. Some sectors will require electrification – such as switching household gas appliances to electric ones and driving electric vehicles. Others require switching carbon-based fuels and inputs to renewable and non-polluting alternatives – such as producing renewable hydrogen that can replace coal and gas for industrial manufacturing. These shifts will create greater demand for renewable electricity.

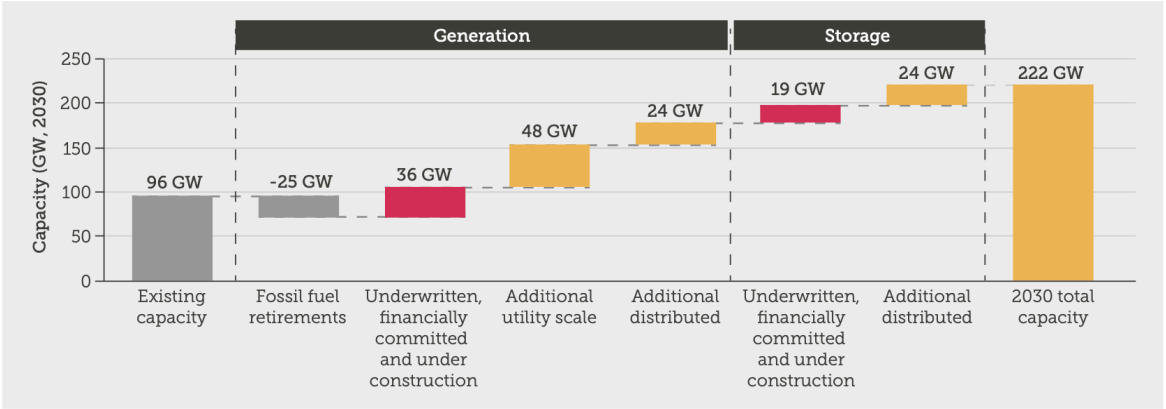
At the same time, we need to secure Australia's economic prosperity in a world that is rapidly decarbonising. The European Union's Carbon Border Adjustment Mechanism will come into full effect in 2026, which will cause Australia's top trade partners who export to the EU (for example China, Japan, South Korea) to seek

decarbonised or low emissions intensity products and inputs. This is a moment when countries and corporations are making major investments in new international supply chains. There is a small window of time for Australia to demonstrate its commitment and viability as a supplier of clean export products before these investment decisions are made. Laying the groundwork to secure supply chains for clean export industries requires aligning Australia's energy transition plans with the vast increase in renewable electricity demand from these industries.

The amount of renewable electricity generation we will need is much larger than will be delivered under current Australian Government plans. The Powering Australia Plan has a target of 82% of Australia's electricity supplied from renewable sources 2030, based on a grid that is only modestly bigger than today's. The Climate Council has carried out analysis to calculate the necessary emissions reductions for Australia to do its fair share to limit global temperature rise. Our analysis shows a need to grow Australia's electricity generation and storage capacity from 96 GW in 2024 to 222 GW by 2030, which will then double by 2050 (Climate Council, 2024b). By 2030, we can have a grid that runs on 94% renewables (Climate Council, 2024b).

Figure 1 demonstrates our proposed pathway to developing a cleaner electricity supply, which is closely aligned with the Australian Energy Market Operator's (AEMO) Green Exports Scenario in the 2024 draft Integrated System Plan (ISP). This highlights that building plans around AEMO's Step Change Scenario is not aligned with Australia's ambitions to become a global clean energy superpower. Growing onshore clean manufacturing and other clean energy industries requires planning for a bigger electricity system than current plans, targets and actions will achieve.

Figure 1: Necessary addition of generation and storage capacity to achieve 94% renewable electricity generation with a much larger grid



Source: Existing capacity based on AEMO (2023a), APVI (2024) and OpenNEM (2024); Financially committed and under construction projects based on Clean Energy Council (2024) for generation and battery storage, (AEMO 2023a) for pumped hydro, and Capacity Investment Scheme underwriting based on DCCEEW (2023a); Additional necessary capacity based on Climate Council and ISF analysis (Climate Council, 2024b).

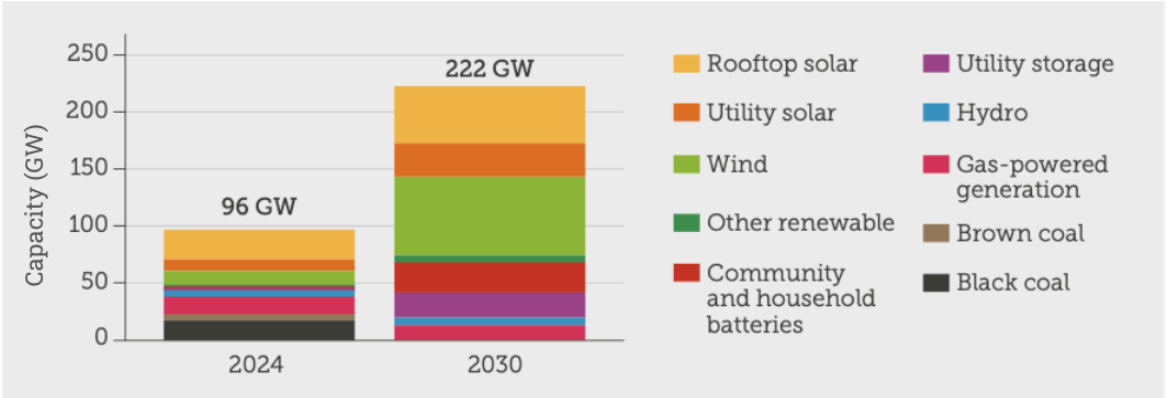
Recommendation 2

The Climate Council recommends the EESP map out a pathway for delivering significantly expanded renewable generation and storage capacity beyond current government plans this decade. This should be based on delivering at least 200GW of clean generation and storage by 2030, continuing to scale up to 2050 in line with AEMO's Green energy exports scenario in the 2024 Integrated System Plan and the scenarios provided in Climate Council's Appendix 1.

2.2. Expanding both large and small scale generation and storage are essential to decarbonise our growing power grid

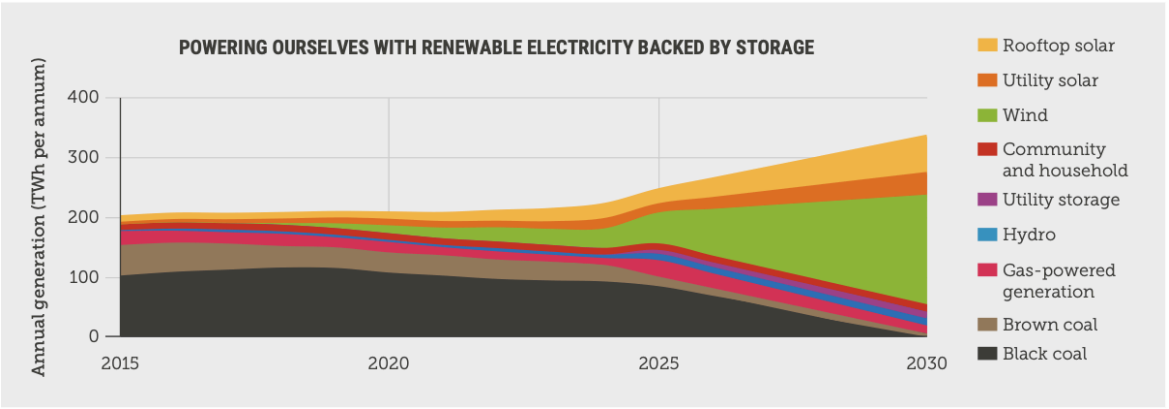
Modelling from the Climate Council shows that Australia can build a secure and reliable electricity system that is one and a half times its current annual generation capacity, and powered with 94% renewable electricity by 2030. Expanding both large-scale and distributed energy resources from residential, commercial and industrial sectors are crucial to achieve the necessary renewable capacity. The Climate Council analysed what it will take to keep our grid stable and reliable all year round, and in all types of weather, as we power it almost entirely with renewables. We recommend combining rooftop solar and batteries on homes and businesses, with large-scale renewables like onshore wind and solar farms and storage like big batteries and pumped hydro. Figure 2 and figure 3 show the change in electricity capacity mix up to 2030.

Figure 2: Comparing Australia's electricity capacity mix between 2024 and 2030



Source: 2024 capacity based on AEMO (2023a), APVI (2024) and OpenNEM (2024); 2030 based on Climate Council and ISF analysis (Climate Council, 2024b).

Figure 3: Changing energy generation mix from 2015 to 2030 (NEM only)



Source: Generation refers to the NEM only. Historic generation based on AEMO (2023a); projected generation based on Climate Council and Institute for Sustainable Futures analysis (Climate Council, 2024b).

Current Australian Government policies are crucial in driving the increase of renewable capacity. For example, the Capacity Investment Scheme will underwrite 32 GW of renewable energy capacity by 2030. An additional 72 GW of generation and 24 GW of storage will be needed to reach the necessary capacity by 2030.

To bridge this gap, distributed energy generation and storage from households rooftops can play a key role. Generating and storing energy near where it is used, in homes, businesses and communities, will help make our system more resilient and more efficiently leverage infrastructure and resources. The Climate Council's analysis identified that four million more rooftop solar systems on Australian homes can contribute 24 GW of renewable generation capacity. Installing two million household batteries and 5,000 community batteries can provide another 24 GW of storage capacity (Climate Council 2024). There is even greater generation potential from distributed sources if commercial and industrial buildings and properties are included in the mix. Governments can improve planning laws to require new commercial buildings and car parks to install solar panels, as is currently the case in countries like France and Germany (Ryan 2022). Providing incentives using a model like the current Small-scale Renewable Energy Scheme, which gives credits for small-scale renewable energy generation, can further drive the increase of distributed solar generation capacity.

Further expansion of large-scale onshore wind and solar power generation is also key to bridging this gap. The Climate Council's analysis identifies that an additional 48 GW of large-scale generation capacity will be required by 2030, in addition to what is currently under construction, financially committed, and underwritten by the Capacity Investment Scheme. In order to complement the significant amount of rooftop solar, we expect about 65% of this utility-scale generation capacity is provided by wind, and about 7% by other renewables, like biomass.

Wind and batteries are essential sources of energy for ensuring reliable and stable electricity supply when solar is less available. There is a lot of potential to expand onshore wind generation across Australia, for example in wind abundant inland regions of Western Australia, South Australia and Western Victoria, and along the exposed areas of the Great Dividing Range in NSW (Geoscience Australia, 2023). Offshore wind will increasingly play a role in grid reliability due to its higher capacity factor, and ability to be co-located in the proximity of significant industrial load. Working closely with communities to address environmental and social concerns surrounding offshore wind installations is crucial to avoid delay of any planned development of offshore wind. For large-scale energy storage, proceeding with currently planned pumped hydro projects, such as Snowy 2.0 (NSW), and Kidston and Borumba (QLD) will add a significant amount of storage capacity and be sufficient for our needs by 2030.

Recommendation 3

In mapping a pathway for significantly expanded renewable generation and storage capacity, the Climate Council recommends this be based on an optimised mix of utility and consumer energy resources which maximises the potential of all forms of renewable electricity. Both large and small-scale generation and storage will be essential to delivering the power Australia needs rapidly, and at scale. In particular, the Climate Council recommends an increased focus on expanding residential, commercial and industrial solar and onshore wind as near-term priorities to bring more renewable generation capacity online sooner.

2.3. Phase out coal-fired power generation sooner and plan for a limited role for gas

The Intergovernmental Panel on Climate Change, has shown that faster action to phase out fossil fuels is required than our current pace if we are to secure a liveable future (IPCC, 2023). Fossil fuels account for more than 75% of global greenhouse gas emissions and nearly 90% of all carbon dioxide emissions (IPCC, 2023). In Australia, despite the significant rise in solar and wind energy, we are still generating the most climate pollution per capita among the G20 countries from burning coal (Morton, 2023).

Electricity currently makes up 33% of Australia's emissions. By 2030, electricity is projected to account for 20% of total emissions and only 11% by 2035 (DCCEEW, 2023b). We can cut the share of emissions from electricity even further by accelerating both the deployment of renewables and the phase out of fossil fuels, especially coal and gas. AEMO's analysis for the draft 2024 ISP shows that ten large coal-fired generators have closed in the past decade. All but one generator in the fleet have announced planned retirements by 2051, and half by 2035. Yet, the ISP forecasts that the remaining coal fleet will close two to three times faster than those announcements, with all coal-fired generators exiting by 2038 (AEMO, 2023a). The Climate Council's analysis shows that with increased adoption of solar and wind, we can phase out coal entirely from electricity generation by 2030 (Climate Council 2024b).

Despite the commercial viability of coal-fired power generation rapidly deteriorating, there are calls for governments to intervene to keep some generators open beyond stated closure dates. This should be avoided. Delaying the inevitable by attempting to delay the closure of any coal-fired power station only serves to worsen power prices and slow the clean energy transition. For example, delaying the closure of Eraring coal-fired power station alone could increase household power bills by $200 to $300 per year (Nexa Advisory, 2023). Governments must stay the course on the transition to renewable energy, providing certainty and stability for investors, grid operators and households alike.

The role of gas in the electricity system is also quickly diminishing. The Climate Counci's analysis shows that a small amount of gas will be needed for peaking in the short term, about 6% of generation per annum. In the longer term, this peaking need can be met with longer lead time projects: increased interconnection, further deep-storage including pumped hydro, and larger amounts of dispatchable renewable generation delivered through either biomass, renewable hydrogen or ammonia (Gilmore, Nelson and Nolan, 2023). It will not be necessary to call on gas for consistent power, generated throughout the day. This need can be met through variable renewable generation and storage.

Concerns about there being a shortage of gas is unfounded. AEMO's Gas Statement of Opportunities notes that annual gas supply from existing, committed and anticipated production should be adequate before 2027 (AEMO, 2023b). Efficient, affordable and reliable alternatives to gas, for both electricity generation and industrial purposes, are available today and there will be even more in the future. We need to scale up these alternatives, and avoid embedding gas in long-term planning for the electricity system in particular – as well as the broader energy system.

It is critical that the government plan for the orderly decline of the gas network. Left simply to the market, heavy fixed costs will be increasingly recovered from remaining users which could have profound impacts for the Australian economy. Avoiding death spiral conditions requires a planned decline that is supported by consumers, investors and the community. This is discussed further in section 4.2. of this submission.

Recommendation 4

The Climate Council recommends the EESP anticipate and make provision for the accelerated end of coal-fired power generation within Australia's electricity grid. This would acknowledge that AEMO's current expected end date of 2038 has been progressively revised over time, and ongoing changes in the economics of the electricity market make earlier closure of coal generators highly likely.

Recommendation 5

The Climate Council recommends the EESP plans for gas to only be used for short-term reliability and peaking capacity, and explicitly rule out the further development or expansion of gas-fired power generation within Australia's electricity networks – unless it can run on 100% renewable hydrogen. There is sufficient capacity already in place, as zero emissions long-duration and distributed storage options are rolled out.

3. Electrification and energy efficiency move together to manage demand

To drive down emissions across Australia's economy, we need to rapidly replace fossil fuels wherever they are used today. There are significant opportunities to replace coal, oil and gas with clean electricity in our homes, businesses and industries. These opportunities will continue to expand as new technologies and alternative zero emission fuels made with clean feedstocks become available in coming years.

Electrification improves energy efficiency in its own right. Where current processes which burn fossil fuels lose much of their energy as heat, clean electricity avoids the significant heat-based energy losses associated with combustion-based energy. However, increased electrification will need to be paired with a strong focus on delivering further efficiency measures to manage an effective transition to our larger, clean grid.

It is essential that the EESP anticipates and responds to the widespread electrification of homes, transport and industry in setting out plans for the size and design of our future clean electricity system. While these sectors will be the subject of standalone analysis as part of their respective pathways currently under development, action in these areas can either be enabled or curtailed by the scope of action laid out in the EESP.

3.1. Anticipate accelerated electrification and improve efficiency of homes and commercial buildings

There are readily actionable steps to electrify and improve energy efficiency in residential and commercial buildings. These can reduce emissions and provide cost savings for both consumers and governments. Buildings across Australia are being upgraded and retrofitted to take advantage of the significant cost savings on top of emissions reductions that come with improving energy efficiency and electrification. Electrifying homes and workplaces using efficient electric appliances can ease cost of living pressures, saving Australian households from $1,119 to $2,872 a year depending on where they live (Climate Council, 2023b). Improving the energy efficiency of buildings will further deliver cost savings by reducing demand for electricity. Relatively low cost upgrades can help improve the thermal efficiency of residential buildings by approximately 8% and commercial

buildings by approximately 12% (Climate Council, 2024b). With more than five million homes around the country that currently use gas for heating, cooking or hot water needing to make the switch (Energy Networks Australia, 2021), the EESP needs to anticipate and plan for this increased electricity demand.

Alongside supporting retrofitting of existing buildings, the government can help ensure all new homes and commercial buildings are built to high efficiency standards and with all-electric, efficient appliances. Around 170,000 new homes are built each year in Australia; over the coming decades this adds up to millions of new homes. The Australian and state governments can agree on a national approach and timeframe for requiring all-electric new homes, including apartments, and general commercial buildings around Australia. Some jurisdictions have already started down this path: the ACT ceased gas connections to new homes in 2023 and Victoria started requiring all-electric builds in January 2024.

Pairing rooftop solar with energy efficient, electrified homes and commercial buildings has a threefold benefit: adding renewable electricity generation capacity; further reducing energy costs for consumers; and helping the resilience of the grid by producing energy close to where it is consumed.

We are encouraged to see that the recently-released National Energy Performance Strategy emphasised energy efficiency and electrification as important demand side decarbonisation mechanisms and provides the framework for the government to decarbonise residential and commercial buildings around Australia (DCCEEW, 2024). The Climate Council emphasises that with existing technologies already available, there are many opportunities to accelerate energy efficiency improvements and electrification in this sector and the EESP needs to work together with the Built Environment Sector Plan to address these considerations. Further recommendations on specific policy actions governments can take are provided in Section 4 of this submission.

Recommendation 6

The Climate Council recommends the EESP adopt electricity demand assumptions based on strong levels of electrification and improvements in energy efficiency across homes and businesses, and outline key policy and regulatory actions to enable this. In particular, the EESP should include government-led initiatives to ensure all new homes and commercial buildings are built to high efficiency standards, with all-electric and efficient appliances and rooftop solar wherever possible.

3.2. Anticipate accelerated uptake of electric transport alongside mode shift, and address barriers to two-way use of energy

Two major drivers of decarbonisation in the transport sector will be electrification and encouraging a mode shift from private vehicles to shared and active transport. There is a limit to how quickly we can electrify Australia's passenger vehicle fleet, and it is unlikely to happen at the necessary rate to facilitate necessary emissions reduction in transport this decade. Enabling Australians to move around in different ways is an important mechanism for energy efficiency that will also help reduce the pressure on the energy system to manage a massive increase in vehicle fleet electrification.

The Climate Council's analysis identifies the opportunity of shifting 30% of projected private vehicle kilometres to shared and active transport by 2030. Shared transport refers to traditional public transport modes like buses and trams, alongside rideshare, taxi services, and other shared user modes which can be electrified. Active transport refers to options such as cycling and walking. The EESP should not assume and plan for every petrol vehicle today to be replaced with an electric vehicle (EV), as enabling Australians to use these shared and active transport options for more trips, more often is an important decarbonisation opportunity. It also helps to address a range of other social challenges like air pollution, congestion, road safety and household costs of living. For this reason, the EESP needs to work together with the Transport and Infrastructure Sector Plan to ensure mode shift is at the heart of all relevant government plans and that policy and investment work together to enable it.

Alongside enabling increased uptake of shared and active transport, governments should prioritise and accelerate electrifying vehicles that travel the most kilometres first. Priority examples include taxis, rideshare vehicles and government fleets. Jurisdictions around Australia have already shown support for electrifying their public and shared fleets, with some states and territories committing to transition targets (Kolar and Staheli, 2023). Yet with only 0.2% of the current bus fleet electrified (Denniss et al, 2023), there is an opportunity to accelerate this transition. The EESP should plan to prioritise electrification of these shared and public vehicle fleets, alongside strong assumptions about the uptake of private EVs. In the Climate Council's analysis, one-third of all passenger kilometres can be travelled by electric vehicles by 2030, alongside 17% of all road freight by volume. The EESP needs to

account for this level of additional demand, both in terms of meeting increased electricity needs and planning infrastructure and network augmentation.

With the right infrastructure and technologies for enabling vehicle-to-grid or -home (V2G or V2H) applications, EVs can serve a dual purpose as both zero emissions transportation and household energy storage. As with any other battery, EV batteries can be charged with solar and discharged back into the grid or a home at times of high demand. While the technology is still nascent, there are already vehicles on the market that have V2G and V2H capabilities – such as the Nissan Leaf and the Mitsubishi PHEV. Supported by the Australian Renewable Energy Agency (ARENA), the ACT Government has been piloting V2G projects to demonstrate its economic viability in Australia (ACT Government, 2023).

The EESP should clarify what role the Australian Government expects V2G can play in the energy system and identify actions to overcome barriers, to enable EVs to be effectively integrated into the distributed energy system. As the transport system continues to electrify, there are also opportunities to ensure charging of EVs is demand-responsive, aligned with periods of daily peak supply, when gigawatts of renewable electricity generation is currently being curtailed and effectively wasted.

Recommendation 7

The Climate Council recommends the EESP adopt electricity demand assumptions based on the priority full electrification of public and shared vehicle fleets, and significantly increased uptake of shared and active transport compared with current levels. This would recognise that Australia's optimum emissions reduction pathway involves greater use of shared and active transport modes, rather than a direct conversion of the entire private vehicle fleet to electric vehicles. The EESP should also account for a significant increase in electrified road freight and rail in future decades, which will require additional infrastructure planning and network augmentation alongside additional generation capacity.

Recommendation 8

The Climate Council recommends the EESP recognises and addresses the potential for technologies such as vehicle-to-grid discharging to provide additional distributed energy storage capacity as more of Australia's fleet electrifies.

3.3 Create the right incentives and frameworks for industrial electrification and efficient use of energy

Industry accounts for a large portion of Australia's total energy use and emissions. Data from the ABS Energy Account 2021-2022 shows that manufacturing uses almost 1000 petajoules of energy per year and accounts for about a quarter of total energy use (ABS, 2023). It also accounts for around 12% of Australia's emissions. Mining also accounts for a substantial portion of energy use, using almost 650 petajoules per year, and accounting for 22% of Australia's emissions when fugitives are included.

The Climate Council's research indicates that, contrary to common perceptions, there are already significant opportunities for fuel switching, electrification and energy efficiency in industry.

Switching from using gas for heat to efficient electric technologies is possible now for industries that require lower temperatures, such as food and beverages, light manufacturing, the paper industry and some parts of the chemicals industry. For other parts of industry that require higher temperatures (e.g. cement and metals manufacturing), biomass and biofuels can play a larger role before 2030 than they currently do. Increasing circularity – such as through onshore recycling of steel and aluminium – can also cut emissions from these industries. The Climate Council's modelling assumes that 35% of steel and 40% of aluminium can be produced from recycled materials in Australia by 2030. In mining, there are also many opportunities to replace diesel with electric motors in haulage trucks, loaders, drill rigs and other equipment. Overall, maximising electrification alongside fuel switching and increased circularity would reduce the use of coal in industry by 41%, oil products such as diesel by 86% and gas by 31% by 2030 (Climate Council 2024b).

Much of Australia's industrial activity occurs in regional communities, where large-scale solar and wind resources are also abundant. An electrified industry sector therefore has significant potential to meet its energy needs with onsite or nearby large-scale renewable electricity generation. Developing Renewable Energy Industrial Precincts to co-locate industrial activities with large-scale renewable electricity generation can minimise the need for new transmission and better streamline delivery of the large amounts of energy required for electrified mining and manufacturing.

These precincts would best be planned in places like Townsville and Gladstone in Queensland, the Pilbara and Collie in Western Australia and the Hunter and Illawarra in New South Wales, which have history and deep skill-base in industrial

processes and will continue to be important for low emissions export industries in the future. When Renewable Energy Industrial Precincts are developed in collaboration between government, industry and renewable energy providers, they can match energy suppliers with new energy customers in key strategic industries to effectively unlock private investment at both ends. Identification of priority locations for these precincts should be co-designed with local communities, unions and industry. The EESP needs to enable industry electrification through the design of the electricity grid to allow for co-location of compatible energy generation and consumption activities.

Beyond 2030, the full decarbonisation of industry will depend on the availability of affordable zero emission fuels like renewable hydrogen. Producing these at scale will require additional renewable electricity generation capacity, above and beyond the more than 200 GW required by 2030. This reinforces the need for the EESP to plan generation capacity in alignment with AEMO's Green Energy Exports scenario as without this increase in capacity, it will not be possible to fully decarbonise Australia's existing industries, let alone create new ones.

Recommendation 9

The Climate Council recommends the EESP recognise the opportunities for electrification and energy efficiency in industry and make provisions for significant direct fuel switching to clean electricity in industry in the near term to enable these opportunities. To meet the high demand for energy, the EESP needs to consider the strategic placement of large-scale renewable electricity generation and industrial activities to optimise transmission and generation infrastructure developments.

3.4. Prioritise the use of hydrogen for onshore clean industries ahead of direct export or other uses

With the expansion of hydrogen in the decarbonised economy, we stress the importance of ensuring hydrogen is created with zero emissions. Renewable hydrogen is produced using electrolysis, where renewable electricity is used to split water into hydrogen and oxygen. Only hydrogen that is produced with a zero emissions electricity source can accurately claim to produce zero emissions. Traditional methods of hydrogen production – such as steam methane reforming (SMR) or coal gasification – are reliant on fossil fuels which contribute to

greenhouse gas emissions. These types of hydrogen are often promoted by gas corporations as 'clean' or 'low emissions' gases but they should not be considered as such because of their ongoing contribution to climate change (Climate Council, 2023c).

The renewable hydrogen industry in Australia is in early stages of development, but it will replace fossil fuels in more use cases as both its upfront investment and the production costs of hydrogen-based manufacturing technologies decline. By 2030, The Climate Council's analysis estimates around 7 petajoules of renewable hydrogen can be manufactured in Australia. This initial, limited supply needs to be prioritised for industrial use and not diverted to other uses like heating homes or powering light passenger cars where electrification is a better option. Declining costs and greater amounts of renewable electricity generation will increase availability of renewable hydrogen, which may then contribute in limited form to other sectors beyond this fuel's highest and best use in industry.

While hydrogen has primarily been seen as a solution to addressing climate change, we need to be careful with how we expand its use. We have never used hydrogen at the scale that is anticipated in the coming decades as the world decarbonises. When hydrogen is combusted, the only byproduct it produces is water. However, because it is such a small molecule, hydrogen is hard to contain while storing and transporting it, so it can easily leak into the environment. When there is an increased concentration of hydrogen in the atmosphere, it can reduce the availability of hydroxide, which regulates the concentration of other greenhouse gases (like methane). This can weaken the removal of methane and extend its life in the atmosphere (Bertagni et al., 2022).

In the past, the harm that large-scale use of fossil fuels would have on the climate and the environment was not anticipated when scaling up these industries. Similarly now, the interaction that large amounts of hydrogen will have with Earth's climate system is not fully understood. Governments should invest in research and development to explore both hydrogen's role in chemical reactions in the atmosphere and its safety thresholds, as part of determining its optimal deployment pathways (see Pearman and Prather, 2020).

As Australia's renewable hydrogen industry develops, we must prioritise the development of fully renewable hydrogen only, and direct its limited supply to industrial processes close to hydrogen production sites. This will minimise the need to store and transport this fuel, and reduce as much as possible the chance of leakage leading to unpredictable climate impacts.

Recommendation 10

The Climate Council recommends the EESP explicitly prioritises the use of renewable hydrogen for replacing fossil fuel inputs and high heat fuel in industry. Given the inefficiencies, challenges, and risks of storing and transporting hydrogen, the EESP should not assume renewable hydrogen will be deployed as an energy source in households, transportation or directly in exports.

4. Design for a limited and diminishing role for fossil gas

The Australian Government – through the EESP – needs to have a clear and decisive position on phasing out fossil gas. Fossil gas generates carbon and methane emissions at every stage of its supply chain – when it is extracted, processed and burnt. It is predominantly made of methane, which is the second most significant greenhouse gas after carbon dioxide, and is responsible for at least 30% of the rise in global temperatures since the Industrial Revolution (IEA, 2023a). The IEA's Net Zero by 2050 analysis suggests that there cannot be any new gas fields approved for us to reach net zero by 2050. There is a small and diminishing role for gas in our electricity and energy system in the near term, leading to this fossil fuel being phased out altogether in the next decade. We need to direct investment towards what can power us cleanly, reliably and safely in the long term, which is renewables and zero emissions solutions.

Any further investment into fossil fuels is undermining our efforts towards decarbonisation, creating uncertainty for investment and wasting much-needed investment dollars that could be put towards renewable solutions that will not cause more climate harm. In Australia, we have more than enough gas to meet our domestic energy and industrial needs. Prolonging the discussion of whether or not to expand gas extraction reduces the time and focus needed to work through the practical steps of phasing this industry out. The EESP needs to be decisive about winding down all fossil fuels – including gas – and set a timeframe for gas to leave the energy system entirely. Some specific considerations the Climate Council recommend the EESP incorporate include:

1. Rule out any reliance on carbon capture, utilisation and storage (CSS/CCUS) as a way to decarbonise fossil gas and focus on genuine solutions for reducing emissions by replacing fossil gas entirely.
2. Set timeframes and an orderly process for winding down gas distribution networks and infrastructure.
3. Anticipate declining global demand for fossil gas and set a clear pathway for ending gas extraction and use as soon as possible.

4.1. Carbon capture and storage is not a viable solution for reducing emissions from fossil gas

The EESP should be planning for an electricity grid that is fully powered by renewables. CCS/CCUS that seeks to capture carbon and methane as they are being released through gas extraction and production processes are a costly, ineffective

and inefficient way to address emissions. CCS/CCUS projects can never be genuine solutions to the harmful impacts of gas on climate and communities, because they do not stop large amounts of carbon emissions from being released into the atmosphere when gas is burned for fuel.

Suggestions by industry that CCS/CCUS technologies can genuinely mitigate emissions in a scalable and cost effective way are only seeking to prolong their polluting practices. The Institute for Energy Economics and Financial Analysis (IEEFA) has observed that underperforming carbon capture projects outnumber successful projects globally by a large margin (Robertson, 2022). It would be far more effective and cost efficient to avoid emissions in the first place than to try and capture or extract them from the air and sea. Even if the technology could perfectly capture the emissions from gas extraction and processing, it would still do nothing to address the much larger volume of emissions produced when fossil fuels are burned for energy. Emissions from using Australia's gas exports are around eight times greater than the emissions produced by gas extraction and processing here in Australia (Browne and Swann, 2017).

Across all sectors, the priority for research and investment should be on technologies which can genuinely and permanently cut harmful carbon pollution - not just attempt to capture and store a small proportion of it. The EESP should prioritise plans for the full replacement of fossil gas with genuinely zero emission alternatives, particularly renewable hydrogen produced with clean electricity, over plans to reduce or notionally capture fossil gas emissions. Approving new or expanded gas projects on the basis they will try to use CCS/CCUS will lead to more harmful carbon pollution. It must not be used to justify more extraction and use of gas.

Recommendation 11

The Climate Council recommends the EESP rules out any reliance on CCS or CCUS as a method for reducing emissions from fossil gas and makes provision for a full replacement of fossil gas with genuinely zero emissions alternatives. This will require actions and policies supporting increased renewable electricity production specifically to produce zero emission fuels like renewable hydrogen.

4.2. Design the gas system for rapid and orderly phase out and optimise for demand reduction

Gas production in Australia far exceeds our domestic needs. More than 80% of Australia's gas production is used for export purposes, and only about 15% is used for domestic residential, power generation and manufacturing needs (DCCEEW, 2023b). With increasing adoption of renewables and efforts for electrification in homes, businesses and industries, gas is playing a small and diminishing role in the domestic context. The Climate Council's analysis shows that by 2030, we can limit the proportion of gas used for electricity generation to just 6% (Climate Council 2024b). Our analysis shows that we can achieve a 100% renewable electricity grid by 2035. With gas exiting the electricity system and being replaced with renewables in industry, what is left is to discontinue the use of gas in heating and cooking in homes and commercial buildings.

The energy sector needs to plan for winding down gas distribution networks, starting with ending their further augmentation. The process for disconnecting gas networks needs to account for potential perverse effects on consumer prices. The costs of gas infrastructure are embedded into consumer gas bills. As gas prices increase and households and businesses switch to cheaper electric alternatives, gas producers are left with high distribution network costs, which they will spread over fewer and fewer customers (Acil Allen, 2020). Without focused government action, there is a risk that the remaining customers who are left to pay increased prices are also those who are least able to afford them. The EESP must design a phase out process that avoids this, and accelerates the rollout of clean, renewable electricity to replace gas in our homes and businesses.

In practice, the Australian Government can direct the Australian Energy Regulator to require the accelerated depreciation of gas network assets to be written down by a set date, for example 2035 or 2040. Setting a date for gas assets to be written down in an orderly way, would mean the number of gas consumers and the annual charges they would pay will scale down with the reduction of the gas network. Gas network operators pass on the cost of running and upgrading their distribution networks to gas customers. As more buildings electrify and leave the gas network, there is a risk that all the costs will be borne by fewer people, resulting in higher bills for those who are least able to pay them. This would enable the gas network to be scaled down in a coordinated way. This approach was adopted in the most recent price determination by the Australian Energy Regulator for the ACT, where the government has commenced a coordinated phase out of gas (AER, 2021).

Recommendation 12

The Climate Council recommends the EESP recognises the diminishing role of gas as all sectors electrify and sets realistic timeframes for winding down gas distribution networks in an orderly way, starting with an immediate end to any further augmentation.

4.3. Plan for diminishing international demand for fossil gas

Along with diminishing domestic demand for gas, international demand is also expected to fall in the near term. Since most of the gas Australia produces is turned into liquified natural gas (LNG) for export markets (DCCEEW, 2023c), we need to prepare for the anticipated decline in demand for gas by ending any further expansion of exploration and extraction.

In its World Energy Outlook, the International Energy Agency projects that global demand for gas will peak before 2030 and decline in the next decade (IEA, 2023b). While projections for gas in 2024 are expected to increase slightly, mature markets for gas fired power generation are already slowing down. Gas consumption in Europe fell by 7% in 2023 due to strong expansion of renewables and availability of other zero emission energy sources (IEA, 2024a). The largest customers of Australian LNG – Japan, South Korea and China – have each made commitments to reach net zero emissions by 2050, and 2060 in the case of China, and their demand for gas is beginning to shrink as a result (Denis-Ryan, 2024). Meanwhile, the IEA has noted there is a large amount of additional gas capacity coming online globally from 2025 (IEA, 2024b). Declining demand and increasing supply of gas in the global market makes further investments in gas expansion a highly unprofitable exercise for Australia, in addition to its dangerous climate impacts.

With priorities to reduce methane emissions from the energy sector, a shrinking global market for gas and a declining domestic need due to accelerated electrification, the EESP should set out a clear pathway for the phase out of export gas demand in parallel with a phase out for domestic use. This includes ruling out any expansion of gas extraction and production.

Recommendation 13

The Climate Council recommends the EESP plans for rapid domestic and international reductions in demand for fossil gas, with a clear pathway for ending fossil gas extraction and use as soon as possible.

5. Government has a leadership role in navigating towards a zero emissions energy system for Australia

Australia, and the world, is undergoing a once-in-a-century economic and social transformation. Steering our society through this shift requires a clear, positive vision of the inclusive clean economy we want to build now, to power the next era of Australia's prosperity. It also requires overcoming entrenched market forces and social norms that have fuelled our current climate crisis. Australians are looking to the government for leadership. The majority of Australians (72%) believe that the government has the ability to influence climate change through its decisions. Two-thirds (66%) of people feel Australia should be taking more decisive action to address climate change (Ipsos, 2022).

The government's role in leading the transition is to create certainty for communities and industries through decisive actions that support and enable communities to make necessary changes by removing systemic barriers, and position Australia competitively in the new economy. Key components of this include:

1. Investing in the skills and workforce needed to transition to, and maintain, a zero emissions economy.
2. Ensuring that all communities are included in the shift to clean energy, and everyone has access to the benefits of electrification and energy efficiency.
3. Providing avenues for genuine engagement, shared ownership and co-design with local communities on the rollout of large-scale renewable electricity infrastructure.
4. Providing oversight and ensuring policy coherence and integration across all sector plans throughout planning and implementation stages.

5.1. Invest in skills and workforce for a zero emissions economy

The government needs to accelerate workforce development to build the renewables infrastructure needed to power Australia's domestic electricity requirements. In doing so, the government can provide quality and steady jobs that benefit

communities across the country. The Clean Energy Generation report (2023) found that, to electrify the NEM, we need 26,000 to 42,000 more electricians by 2030, and 31,000 more people in the clean energy supply workforce by 2050. The report also highlighted the need for close to two million workers in building and engineering trades by 2050. This represents a massive opportunity to create well paid and stable jobs, particularly in regional areas, as we support workers to shift out of jobs in declining fossil fuel industries.

Achieving ambitions of becoming a green export superpower makes the urgent need for clean energy workforce development more pronounced. The Climate Council modelled a conservative scenario to determine the annual Australia-wide renewable energy capacity required to service a modest green exports industry out to 2050. The results showed that producing an increasing amount of alumina onshore by 2050 and growing green hot briquetted iron production (to about 315 Mt per annum) by 2050 will require annual installations of renewables in the order of about 22 GW per annum in 2030 and around 35 GW per annum out to 2050. The only way to deliver that level of annual capacity installations is to build the necessary workforce, skills and capacity in the 2020s. Building a green exports industry in the 2030s and beyond would maintain continuity of demand for this workforce, thereby avoiding a boom and bust situation for workers.

The Climate Council recommends the Australian Government implement the following initiatives for accelerating the training and upskilling of a large new energy workforce:

- **establish the Australian Energy Corps as an integrated network for training, placing and supporting energy workers.** This involves bringing together existing national skills and training initiatives with new components to maximise the speed and effectiveness of high-quality training that directly connects workers to good quality jobs. The program could run for a fixed 10-year period to boost the renewable energy workforce in the critical near-term period for delivering new infrastructure. The Australian Energy Corps would include:
    - Free apprenticeship training for participants in electrical and renewable energy trades;
    - Safe, supervised on-the-job training and placement on major renewable energy projects;
    - Simpler requirements and reduced paperwork for companies; and
    - Dedicated streams for new apprentices and upskilling or reskilling workers.

- **support existing trades workers to upskill and repurpose their skills to benefit from the strong pipeline of jobs in energy efficient and zero-emission building work.** There is an opportunity to support trades workers to upskill on energy efficiency and zero-emission building at the point where they need to renew their licences for their respective trades. Industry and unions can collaborate to create and deliver appropriate training that builds on these workers' existing skills. There is a particularly important opportunity to match existing skills from declining fossil fuel industries with those needed for expanding renewable energy generation and infrastructure. For example, the government can support Australia's gas-fitting workforce to shift towards electrical work needed to retrofit millions of homes with electric heating, hot water systems and stoves. Government agencies can partner with unions and industry to develop training materials specially designed for existing qualified workers to shift from gas-fitting to electrical trade that avoids re-training in areas they are already skilled in.

The EESP needs to incorporate measures to support training a large number of energy workers as soon as possible, to ensure Australia has enough skilled workers to deliver the ongoing pipeline of work expected over coming decades and share the benefits of these jobs widely across the community.

Recommendation 14

The Climate Council recommends the EESP identifies actions, investment plans and timeframes for all levels of government to collaborate on growing Australia's skilled energy workforce - both by training new workers and updating the skills of current energy workers. This submission provides a number of priority recommended policy actions for implementation this decade to achieve this.

5.2. Ensuring all households have access to ways to electrify their homes and improve its energy efficiency

All communities across the country can be part of Australia's shift to clean energy , but some will need focused assistance to do so. Section 3.1. of this submission highlighted the importance of electrifying and upgrading homes to be energy efficient, and the need to significantly expand distributed solar electricity generation and storage. The upfront costs of home upgrades and installing rooftop solar and batteries can be a significant barrier for some Australians. Those who do

not have the funds or are unable to access affordable financing from commercial lenders stand to benefit the most from cost savings associated with clean energy home improvements. They must not be left behind in the energy transition. The Climate Council recommends the Australian and state governments implement the following initiatives to ensure a fully inclusive shift to clean energy, with key federal initiatives reflected in the EESP:

- **Provide low cost financing to help with the affordability of clean energy and efficiency upgrades.** Some jurisdictions have already implemented programs like these. For example, in the ACT, homeowners and landlords can access a zero interest loan of up to $15,000 to pay for a range of renewable energy, electrification and efficiency upgrades. They can then repay the loan over a term of up to 10 years using the savings from lower power bills. This type of household support is more affordable for governments than direct grants or incentive payments, and so can be provided at a greater scale to help more people. These schemes will need to target lower income homeowners who have limited access to funds for property upgrades, and landlords who are less incentivised to invest in cost-saving upgrades.

- **Use green bonds to finance the installation of rooftop solar and batteries for public housing.** The Australian Government can work with state governments to prioritise financing upgrades to public housing, as well as providing zero-interest financing to social housing providers and nonprofits for upgrades across their properties.

- **Scale up community solar programs to assist those living in apartments and rental properties gain access to clean energy resources**. Several states have piloted the Community Solar Banks initiative, which has successfully improved access to solar power for people who do not live in their own freestanding house.

- **Set stronger minimum construction standards to accelerate energy efficiency, electrification and installation of solar on all new buildings in Australia.** Residential and commercial buildings can be required to meet minimum energy performance standards, which progressively strengthen over time, to drive an ongoing improvement across Australia's homes and commercial buildings. This could commence with all homes sold or rented being required to achieve a 3-star NatHERS minimum energy rating by the end of 2025, with progressive improvements to bring all homes up to a future proof 'net-zero existing buildings' standard by 2030. Upgrades are most cost-effective when they are done at the same time as other work, such as when a property is being prepared for sale or lease (Climateworks Centre, 2023). Having a clear and consistent national minimum standard for energy

performance will ensure property owners prioritise improvements that deliver bills savings and help to maximise the number of homes upgraded.

Recommendation 15

The Climate Council recommends the EESP identifies actions, investment plans and timeframes for all levels of government to collaborate on enabling energy efficiency and electrification upgrades for communities and individuals who are otherwise at risk of being excluded from the shift to clean energy. This submission provides a number of priority recommended policy actions for implementation this decade to achieve this.

4.3. Provide avenues to engage with local communities to gain genuine social license and enable progress

Current processes for planning large-scale renewable electricity projects in Australia tend to be top-down and predominantly driven by commercial project proponents and governments. This approach can leave local communities and landowners feeling disempowered and, in some cases, foster opposition to projects. This issue is now widely-acknowledged and the Australian Government has recently established the Net Zero Economy Authority to focus on it. The Net Zero Economy Authority will be tasked to engage with regions and communities to help them realise benefits from the transition to a net zero economy. How these engagements will work and what kinds of decisions will be shared with local communities will be crucial to the success of the Net Zero Economy Authority and the extent and speed of building out large-scale renewable electricity projects. The Climate Council recommends the Australian and state governments implement the following initiatives to engage communities on renewable electricity projects and infrastructure, with priority actions reflected in the EESP:

- **Work with states and territories to collaborate with local communities to undertake detailed national mapping and planning to identify feasible and appropriate priority areas for the delivery of new renewable electricity infrastructure, by the end of 2025.** The result would be a National Clean Power Map that takes into account environmental, social, cultural and network impacts of siting any new infrastructure. A crucial component of this initiative is to ensure proper engagement and co-design with communities in the development of the map. The process would support communities that want renewable electricity in their regions to put forward

proposals for new infrastructure. It could also involve business and community groups to identify commercial, industrial and large-scale community sites which are suitable for hosting rooftop solar at scale. The map would provide clear guidance on the most suitable locations to site new projects. The Australian and state governments can then provide expedited planning approval for renewable electricity projects that meet delivery standards in the areas that have been identified for inclusion on the map.

- **Establish structures and frameworks for a regional approach to benefit sharing for communities hosting significant renewable electricity infrastructure** – particularly those in Renewable Energy Zones and near Offshore Wind Zones. Regional benefit sharing fosters collaboration and integration by multiple projects or companies when providing benefits to communities. This helps to maximise the reach and effectiveness of benefits provided by energy companies, and ensure they genuinely address high priority community needs. Benefits sharing frameworks can prioritise locally identified needs and community outcomes like sustained lower energy prices, provision of ongoing health services, education, youth and community services, and infrastructure improvements. A better approach to sharing the benefits of new electricity projects will help to foster community and social licence for these important developments.

- **Fund Community Energy Coordinators and serve as a liaison for both project proponents and local communities.** There would be a coordinator in local government areas within Renewable Energy Zones and other suitable areas as identified through the National Clean Power Map. These coordinators would facilitate dialogue between the community, project proponents, and government agencies, enable information flows and foster knowledge sharing about design and delivery of new electricity infrastructure. International examples of this approach can be found in Canada, with the Regional Energy and Resource Tables (Natural Resources Canada, 2022), and Scotland with the Community Climate Action Hubs (Energy and Climate Change Directorate n.d.). These structures facilitate local dialogue and shared ownership of decision-making about renewable electricity infrastructure.

Recommendation 16

The Climate Council recommends the EESP identifies priority actions for immediate implementation that can enable local communities to engage in, and help to accelerate, Australia's shift to clean energy. These processes should

prioritise community voice, autonomy and genuine benefits sharing. This submission provides a number of priority recommended policy actions for implementation this decade to achieve this.

4.4. The government needs to ensure sector plans are designed and delivered as an integrated whole

The energy sector underpins the extent and speed of decarbonisation across all sector plans that feed into Australia's Net Zero Plan. The Net Zero Plan will be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) as our next National Determined Contribution (NDC) and as our updated Long Term Low Emissions Development Strategy (LT LEDS). These key outputs will articulate a holistic view of what governments, industries and communities across Australia will need to work towards.

Australia should aim to achieve a science aligned, fair share reduction in emissions of 75% emissions reductions from 2005 levels by 2030, reaching net zero by 2035. The Climate Council's analysis demonstrates that it is possible to cut pollution further and faster than current plans this decade if all sectors coordinate their efforts and impacts.

Government has a crucial role in maintaining a holistic view and ensuring ongoing monitoring, coordination and policy coherence across sectors. For example, in this submission, we discussed how mode shift can help to decarbonise the transport sector. If over time, Australia does not achieve necessary levels of mode shift, this will impact electricity generation requirements, and delivery then needs to be adjusted upwards. Similarly, planning industrial precincts must be coordinated with the industry sector plan from the outset. The electricity and energy sector plan then needs to monitor and respond to how projects evolve as they progress towards implementation. Working across sectors in this way requires supporting mechanisms for monitoring results and seeking regular and ongoing feedback, so that the energy sector can be responsive to other sectors.

The energy transition requires constant navigation, learning and adjustment to ensure well calibrated interventions at every point along the journey. There are uncertainties and unknowns that communities, governments and industry need to navigate together, so taking an iterative approach with constant learning and adjustment is crucial and can build common trust and understanding. While it

hasn't been a stated purpose of the Net Zero Economy Authority, it can serve a key role to provide oversight and integrate across government departments, their respective sector plans and enabling policies as they are developed and delivered.

The EESP needs to plan for cross-sector monitoring and feedback mechanisms to ensure ongoing policy coordination and coherence through planning and delivery of Australia's decarbonisation targets. This could mean defining processes for regular reporting and collaborative learning events across sectors and communities to monitor progress, collect data and evaluate needs. These processes should include defining comprehensive and integrated energy transition objectives and monitor progress towards those objectives, incorporating evolving trends and developments in social needs, environmental considerations, and economic circumstances.

Recommendation 17

The Climate Council recommends that the EESP integrates with other sectors as they inform the development of the national Net Zero Plan. The EESP should be developed on a timeline and implementation pathway that enables Australia to reach net zero well before 2050, starting with actions that are consistent with achieving a 75% reduction in emissions by 2030. The EESP also needs to stipulate processes, procedures and structures that the government needs to set up to ensure cross-sector policy coherence throughout planning and implementation.

Conclusion

We now live in an era of climate consequences – a time when the impacts of a warming climate are increasingly visible and harming our communities and our environment. This should motivate us all to take necessary and focused action to drive down emissions further and faster than is happening today. We must do everything in our power to limit global temperature rise as close as possible to 1.5°C and prevent escalating climate chaos in the years to come.

The energy system underpins the speed and scope of our transition to a decarbonised economy. The EESP must ensure the energy sector fully enables a rapid and fair shift to a zero emissions society. This means the EESP must plan for and ensure:

1. Australia's electricity grid reaches more than 220 GW of generation by 2030, of which 94% is supplied by renewable sources.
2. Rapid rollout of solutions for electrification and energy efficiency of buildings, transport and industry, in that sequence.
3. A decisive and clear pathway to phase out fossil fuels, including fossil gas.
4. Government recognises its role to lead the energy transition by providing support, coordination, integration and facilitation across all sectors and communities.

Australia is on the journey to end harmful pollution causing climate change. With the progress already made, the top priority is to build out a renewable electricity grid that can serve our communities and build clean industries to ensure Australia's prosperity for generations to come. We have the technologies and techniques to help us drastically reduce emissions within this decade. A well developed EESP can ensure the benefits of smart policies are felt by more Australians and visible in more communities. Now is the time to accelerate necessary action.

Appendix: Seize the Decade modelling approach

Note: This appendix presents a summary of modelling undertaken for Climate Council's *Seize the Decade* report, which guides the content of this submission. The report and technical appendix are available in full at www.climatecouncil.org.au/resources/seize-the-decade

Our plan is based on a comprehensive analysis of Australia's shift to renewable energy. This modelling is based on a granular assessment of the existing and expected demand and supply of energy across the economy. This includes electricity, as well as demand for coal, oil and gas used in industrial production, transport and buildings.

The analysis leverages the advanced version of the One Earth Climate Model (OECM 2.0). The OECM is an integrated energy assessment model, originally designed to find 1.5°C aligned decarbonisation pathways for ten world regions. OECM 2.0 merges an energy system model , a transport model and a power system model into one energy system model with independent demand and supply modules.

Therefore, the model is able to consider the interaction between the electrification of industry, transport and buildings, a necessary phase out of fossil fuels in electricity generation, and energy efficiency improvements. This means our plan provides a comprehensive pathway for Australia to fully embrace renewable energy.

Demand module

The demand for a product (sector-specific gross domestic product (GDP) projections or market forecasts of material flows) combined with the energy intensity of production are inputs to the demand module. From this, the model estimates total energy demand. The demand module uses a bottom-up approach to estimate the energy demand for a process (e.g. steel production) or a consumer (e.g. a household) in a region (e.g. a city or country) or transport services over a period of time. One of the most important elements of this approach is the separation of the need (e.g. to get from home to work), how this need can be satisfied (e.g. with a tram), and the energy required to provide this service (e.g. electricity). This logic underpins the energy demand calculation across all sectors.

Finding pathways to reduce emissions for industry sectors requires very high technical resolution for the calculation and projection of future energy demands and the supply of electricity, (process) heat, and fuels. The energy demand calculation is broken down into the specific energy services that are required:

electricity, heat (broken down into four heat levels: < 100 °C, 100–500 °C, 500–1000 °C, > 1000 °C), and fuels for processes that cannot yet be electrified.

Synthetic fuels, such as hydrogen, are part of both the demand and supply module, because electricity is required to produce it, and the supply module, because it is an energy source for other processes such as manufacturing.

Supply module

After the energy demand has been estimated, the supply of electricity, heat, and fuels on an annual basis was estimated. These annual values are used in conjunction with calibrated proportions of supply technology to provide a breakdown of energy shares across the different supply technologies.

Power systems analysis

Approach

The power systems analysis was conducted to ensure that the electricity supply and demand is balanced throughout the year at hourly resolution, and identify possible additional infrastructure required to achieve a secure and low emissions power supply. This accounts for storage, interconnection and peaking needs.

Key technical assumptions including region breakdowns, interconnection capacity and committed storage investment are based on AEMO's Draft 2024 ISP as the most detailed information source about the Australian NEM power grid.

On the demand side, the OECM power analysis model estimates the development of the future power demand and the resulting possible load curves. The model generates annual load curves with hourly resolution and the resulting annual power demands for households, industry and business and transport. The industry and transport sectors utilise a fixed load profile with demand higher during business/daylight hours and returning towards a baseload value outside these hours. These assumptions are in line with general business and industry load profiles, such that there is a high degree of constant demand from heavy industry operation and increased electricity demand in other business sectors.

The regional distribution of industry load was proportioned according to an approximation of GDP. A simple approach was used for the consideration of electrical demand related to the transport sector, such that demand across all transport types are considered in aggregate and the load profile shaped using the same logic as industry but proportioned across regions according to population.

Results

The assumed capacities and locations of electricity generation and storage technologies were tested against solar and wind data from 2012, in order to produce scenarios comparable to AEMO's ISP.

The hourly analysis for 2030 demonstrated that the chosen electricity generation mix generated approximately 22% more electricity than required. Because of the very high surplus generation in times with strong conditions for wind and solar generation, curtailment still occurred, with all options for storage fully charged. In addition, periods of over and under supply were several months apart, with over supply occurring mostly during sunny periods, and undersupply occurring during winter, with lower capacity of solar and wind resources. Therefore, surplus electricity stored in batteries was not available to address all periods of under supply.

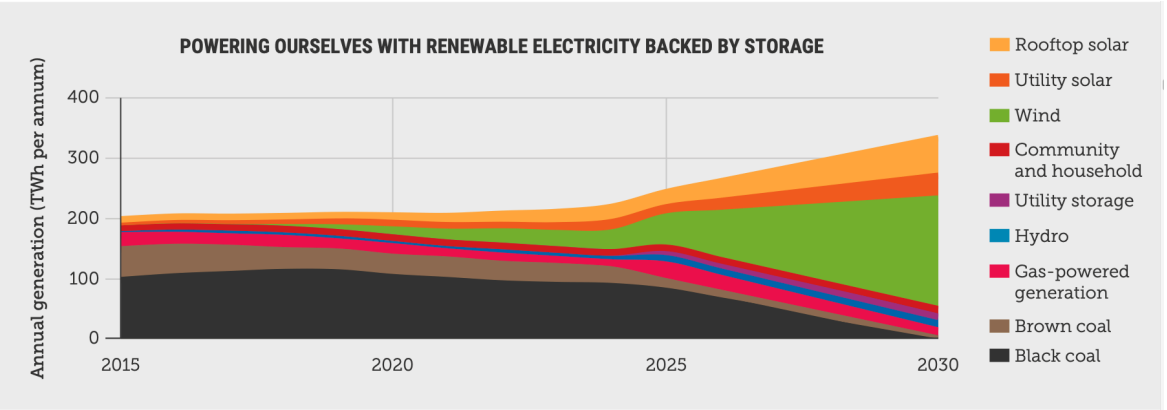
To address this supply gap, three options were considered:

1. Increased interconnection.
2. Increased demand side management.
3. Supply with gas generation.

To 2030, we do not expect further interconnection projects to be developed above and beyond the three projects anticipated by AEMO. In addition, the supply gaps were too great to be achieved with levels of demand-side management which could feasibly be implemented by 2030. As a result of these restrictions, and the fact that additional storage capacity would not cost-effectively reduce the supply gap, gas peaking generation was used to ensure reliability of electricity supply.

A total of 4,698 GWh of gas peaking generation was used to close supply gaps in 2030, increasing electricity sector emissions by 3.8 Mt CO2e to a total of 12.7 Mt CO2e. Accounting for this peaking generation, this modelling identifies a pathway to achieving a 94% renewable electricity sector, with all coal-fired generation exiting the grid by 2030, as presented in Figure A1 below.

Figure A1: Electricity generation technology mix in the National Electricity Market (TWh per annum)



In future, demand for gas peaking can increasingly be reduced through increasing the availability of interconnection, and development of deep-storage projects not available by 2030. In addition, it is likely that 100% renewable hydrogen generation will be available in the early 2030s, offering a zero-emissions solution to supply during periods of extended low wind and solar resources

References

ABS (Australian Bureau of Statistics) (2023). *Energy Account, Australia, 2021-22 financial year*. [online] Australian Bureau of Statistics. Available at: https://www.abs.gov.au/statistics/industry/energy/energy-account-australia/latest-release#energy-stocks.

Acil Allen (2020). *Household energy choice in the ACT*. [online] *Everyday Climate Choices*, ACT Government, pp.1–85. Available at: https://www.climatechoices.act.gov.au/__data/assets/pdf_file/0011/1784315/Household-energy-choices-in-the-ACT-Modelling-and-analysis.pdf.

ACT Government (2023). *The future of Vehicle-to-Grid (V2G) in Australia*. [online] ACT Government. Available at: https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/rattenbury/2023/the-future-of-vehicle-to-grid-v2g-in-australia.

AEMO (Australian Energy Market Operator) (2023a). *Draft 2024 Integrated System Plan*. [online] *AEMO*, pp.1–87. Available at: https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2023/draft-2024-isp-consultation/draft-2024-isp.pdf?la=en.

AEMO (Australian Energy Market Operator) (2023b). *Gas statement of opportunities for central and eastern Australia*. [online] *AEMO*, pp.1–107. Available at: https://aemo.com.au/-/media/files/gas/national_planning_and_forecasting/gsoo/2023/2023-gas-statement-of-opportunities.pdf?la=en.

AER (Australian Energy Regulator) (2021). *AER allows revenue to support gas consumers in transition to renewables*. [online] Australian Energy Regulator. Available at: https://www.aer.gov.au/news/articles/news-releases/aer-allows-revenue-support-gas-consumers-transition-renewables.

APVI (Australian Photovoltaics Institute) (2024). *Mapping Australian photovoltaic installations*. [online] Australian PV Institute. Available at: https://pv-map.apvi.org.au/historical.

Bertagni, M.B., Pacala, S.W., Paulot, F. and Porporato, A. (2022). Risk of the hydrogen economy for atmospheric methane. *Nature Communications*, 13(1). doi:https://doi.org/10.1038/s41467-022-35419-7.

Browne, B. and Swann, T. (2017). *Money for nothing*. [online] *The Australia Institute*, The Australia Institute, pp.1–32. Available at:

https://australiainstitute.org.au/wp-content/uploads/2020/12/P357-Money-for-nothing_0.pdf.

Clean Energy Council (2024). *Clean Energy Projects Australia*. [online] Clean Energy Council. Available at: https://www.cleanenergycouncil.org.au/resources/project-tracker.

Climate Council (2022). *The Lost Years: Counting the costs of climate inaction in Australia*. [online] Climate Council. Available at: https://www.climatecouncil.org.au/resources/lost-years-counting-costs-climate-inaction-in-australia/.

Climate Council (2023a). *Climate Trauma: The growing toll of climate change on the mental health of Australians*. [online] *Climate Council*, pp.1–58. Available at: https://www.climatecouncil.org.au/resources/climate-trauma/.

Climate Council (2023b). *Mission Zero: How today's climate choices will reshape Australia*. [online] *Climate Council*, pp.1–68. Available at: https://www.climatecouncil.org.au/wp-content/uploads/2023/09/Mission-Zero_Updated-190923_IL_2.pdf.

Climate Council (2023c). *What is hydrogen?* [online] Climate Council. Available at: https://www.climatecouncil.org.au/resources/what-is-hydrogen/.

Climate Council (2024a). *Climate Whiplash: Wild swings between weather extremes*. [online] *Climate Council*, pp.1–28. Available at: https://www.climatecouncil.org.au/wp-content/uploads/2024/02/CC_MVSA0392-CC-Report-Mid-Summer-2024_V9-FA-Screen-Single.pdf.

Climate Council (2024b). *Seize the Decade: How we empower Australian communities and cut climate pollution 75% by 2030*. [online] *Climate Council*, pp.1–75. Available at: https://www.climatecouncil.org.au/wp-content/uploads/2024/03/CC_MVSA0394-CC-Report-Seize-the-decade-FA-Screen-Single.pdf.

Climateworks Centre (2023). *Climate-ready homes: Building the case for a renovation wave in Australia*. [online] *Climateworks Centre*, pp.1–56. Available at: https://www.climateworkscentre.org/wp-content/uploads/2023/11/Climate-ready-homes-Building-the-case-for-a-renovation-wave-in-Australia-Summary-report-Climateworks-Centre-December-2023.pdf.

DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2023a). *About the Capacity Investment Scheme*. [online] DCCEEW. Available at: https://www.dcceew.gov.au/energy/renewable/capacity-investment-scheme.

DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2023b). *Australia's emissions projections 2023*. [online] Canberra, pp.1–104. Available at: https://www.dcceew.gov.au/sites/default/files/documents/australias-emissions-projections-2023.pdf.

DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2023c). *Australian Energy Update 2023*. [online] *DCCEEW*, pp.1–51. Available at: https://www.energy.gov.au/sites/default/files/Australian%20Energy%20Update%2023_0.pdf.

DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2024). *National Energy Performance Strategy*. [online] *DCCEEW*, pp.1–52. Available at: https://www.dcceew.gov.au/sites/default/files/documents/national-energy-performance-strategy.pdf.

Denis-Ryan, A. (2024). Australian gas companies need a new strategy as they enter a declining market. *IEEFA (Institute for Energy Economics and Financial Analysis)*. [online] Mar. Available at: https://ieefa.org/sites/default/files/2024-04/Briefing%20note-%20Australian%20gas%20companies%20need%20a%20new%20strategy%20as%20they%20enter%20a%20declining%20market.pdf.

Denniss, R., Quicke, A. and Parrott, S. (2023). *Stuck in the slow lane: Electrification of buses in Australia*. [online] *The Australia Institute*, pp.1–25. Available at: https://australiainstitute.org.au/wp-content/uploads/2023/04/P1321-Slow-lane-electric-buses-Web.pdf.

Energy and Climate Change Directorate (n.d.). *Community-led climate action*. [online] Scottish Government. Available at: https://www.gov.scot/policies/climate-change/community-led-climate-action/.

Energy Networks Australia (2021). *Reliable and clean gas for Australian homes*. [online] pp.1–12. Available at: https://www.energynetworks.com.au/resources/fact-sheets/reliable-and-clean-gas-for-australian-homes-2/#:~:text=In%20the%20last%20decade%2C%20almost,100%2C000%20new%20connections%20per%20year.

Geoscience Australia (2023). *Wind Energy*. [online] Geoscience Australia. Available at: https://www.ga.gov.au/scientific-topics/energy/resources/other-renewable-energy-r

esources/wind-energy#:~:text=Inland%20regions%20of%20Western%20Australia,Highlands%20and%20New%20England%20areas.

Gilmore, J., Nelson, T. and Nolan, T. (2023). Firming Technologies to Reach 100% Renewable Energy Production in Australia's National Electricity Market (NEM). *The Energy Journal*, [online] 44(01). doi:https://doi.org/10.5547/01956574.44.6.jgil.

IEA (International Energy Agency) (2023a). *Methane emissions remained stubbornly high in 2022 even as soaring energy prices made actions to reduce them cheaper than ever*. [online] IEA. Available at: https://www.iea.org/news/methane-emissions-remained-stubbornly-high-in-2022-even-as-soaring-energy-prices-made-actions-to-reduce-them-cheaper-than-ever.

IEA (International Energy Agency) (2023b). *World Energy Outlook 2023*. [online] *IEA*, pp.1–355. Available at: https://iea.blob.core.windows.net/assets/86ede39e-4436-42d7-ba2a-edf61467e070/WorldEnergyOutlook2023.pdf.

IEA (International Energy Agency) (2024a). *Global gas demand set for stronger growth in 2024 despite heightened geopolitical uncertainty*. [online] IEA. Available at: https://www.iea.org/news/global-gas-demand-set-for-stronger-growth-in-2024-despite-heightened-geopolitical-uncertainty.

IEA (International Energy Agency) (2024b). *Renewables 2023: Analysis and forecasts to 2028*. [online] IEA. Available at: https://www.iea.org/reports/renewables-2023/executive-summary.

IPCC (2023). *Climate Change 2023 Synthesis Report A Report of the Intergovernmental Panel on Climate Change*. [online] Available at: https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf.

Ipsos (2022). *8 in 10 Australians are concerned about climate change with a clear public expectation of Government action*. [online] Ipsos. Available at: https://www.ipsos.com/en-au/8-10-australians-are-concerned-about-climate-change.

Jobs and Skills Australia (2023). *The Clean Energy Generation: Workforce needs for a net zero economy*. [online] *Jobs and Skills Australia*, The Australian Government, pp.1–285. Available at: https://www.jobsandskills.gov.au/publications/the-clean-energy-generation.

Kolar, K. and Staheli, R. (2023). *Electric bus evaluation*. [online] *National Transport Commission*, pp.1–58. Available at: https://www.ntc.gov.au/sites/default/files/assets/files/NTC%20-%20Electric%20Bus%20Evaluation.pdf.

Morton, A. (2023). Australia has highest per capita CO2 emissions from coal in G20, analysis finds. *The Guardian*. [online] 5 Sep. Available at: https://www.theguardian.com/environment/2023/sep/05/australia-has-highest-per-capita-co2-emissions-from-coal-in-g20-analysis-finds.

Natural Resources Canada (2022). *Regional Energy and Resource Tables*. [online] Government of Canada. Available at: https://natural-resources.canada.ca/climate-change/regional-energy-and-resource-tables/24356.

Nexa Advisory (2023). *Eraring can be closed on schedule*. [online] *Next Advisory*, pp.1–39. Available at: https://nexaadvisory.com.au/site/wp-content/uploads/2023/07/Nexa-Advisory-Eraring-can-be-closed-on-schedule-Report-24072023.pdf.

NOAA (National Oceanic and Atmospheric Administration) (2024). *Annual 2023 Global Climate Report*. [online] *National Centers for Environmental Information (NCEI)*. Available at: https://www.ncei.noaa.gov/access/%20monitoring/monthly-report/global/202313.

OpenNEM (2024). *OpenNEM: An Open Platform for National Electricity Market Data*. [online] NEM Energy generation, Jul - Dec 2023. Available at: https://opennem.org.au/energy/nem/?range=all&interval=half-year&view=discrete-time.

Pearman, G. and Prather, M. (2020). *Don't rush into a hydrogen economy until we know all the risks to our climate*. [online] The Conversation. Available at: https://theconversation.com/dont-rush-into-a-hydrogen-economy-until-we-know-all-the-risks-to-our-climate-140433.

Robertson, B. (2022). *Carbon capture remains a risky investment for achieving decarbonisation*. [online] IEEFA (Institute for Energy Economics and Financial Analysis). Available at: https://ieefa.org/resources/carbon-capture-remains-risky-investment-achieving-decarbonisation.

Ryan, D. (2022). *France's plan for solar panels on all car parks is just the start of an urban renewable revolution*. [online] The Conversation. Available at:

https://theconversation.com/frances-plan-for-solar-panels-on-all-car-parks-is-just-the-start-of-an-urban-renewable-revolution-194572.

WMO (World Meteorological Organization) (2024). *WMO confirms that 2023 smashes global temperature record*. [online] World Meteorological Organization. Available at: https://wmo.int/media/news/wmo-confirms-2023-smashes-global-temperature-record.